



[www.azclimatechange.us](http://www.azclimatechange.us)

## Agriculture & Forestry GHG Reduction Opportunities

**Key to Indicators:** These are rough estimates based on experience or studies in AZ or elsewhere and are intended to start off discussion. Actual AZ-based estimates will be developed for options that stakeholders decide to pursue in more detail, and may differ significantly from the preliminary indicators provided here.

<b>Indicative Potential Emission Reductions* -</b>	<b>Indicative cost (\$/tCO<sub>2</sub>e)</b>
<b>High (H):</b> Potentially capable of saving at least 1 Million Metric Tons CO <sub>2</sub> e per year by 2020 (~1% of current AZ emissions)	<b>High (H):</b> \$50/tCO <sub>2</sub> e or above
<b>Medium (M):</b> Potentially capable of saving from 0.1 to 1 Million Metric Tons per year by 2020	<b>Medium (M):</b> \$5-50/tCO <sub>2</sub> e
<b>Low (L):</b> Unlikely to yield more than 0.1 Million Metric Tons CO <sub>2</sub> e per year by 2020	<b>Low (L):</b> \$5/tCO <sub>2</sub> e or lower
<b>Uncertain (U):</b> Too many unknowns to estimate	<b>Negative (Neg):</b> Cost Savings
<i>* Several measures overlap in terms of the emissions they would reduce. They may target the same emissions sources, but using different implementation pathways. The estimates shown here assume that measures would be implemented independently from, or instead of, other measures.</i>	

### Indication of Priorities:

- **High:** High priority items are deemed deserving of considerable further analysis.
- **Medium:** Medium priority items will be carried forward, with the extent of further consideration and analysis to be determined later.
- **Low:** Low priority items will be moved to a separate list as options to be potentially considered at a later time.

		Priority: High, Med, Low	Implement. Level & Lead Agency	Potential Emission Reductions	Indicative Cost (\$/tCO <sub>2</sub> removed)	Other Information, Co-benefits, Feasibility Consideration, Examples of Current Activities
<b>Agriculture – Production of Fuels and Electricity</b>						
1.1	Manure Digesters (methane recovery and electricity production)		State, Local Ag. Ext.	Medium	Neg to Low	• Linked with Option 2.2 below
1.2	Biodiesel Production (incentives for feedstocks and production plants)		State	Medium	Med to High	• Production from both virgin and waste vegetable oils;
1.3	Biomass Feedstocks for Electricity Production		State	Low	?	•
1.4	Ethanol Production					• Current debate on the energy required for ethanol production
1.5	Convert Diesel Farm Equipment to LNG or Hybrid Technology					•
1.6	(Additional option, if/as suggested)					•
1.7	(Additional option, if/as suggested)					•
<b>Agriculture – Fertilizer and Manure Management</b>						
2.1	Nutrient Management (improve efficiency of fertilizer use)		State, Local Ag. Ext.	Medium	Neg to Low	• Note Ag. Best Management Practices under ARS §49-457 (do these extend beyond dust control and water efficiency measures?) • Linked to Option 3.4 below.
2.2	Manure Management (practices to reduce methane emissions)		State, Local Ag. Ext.	Medium	?	• Linked with Option 1.1 above. • Existing waste containment requirements for animal feeding operations > or = 1,000 head. • Could include composting and other measures. • Most of the benefit achieved at dairies.
2.3	Change Feedstocks (optimize nitrogen for N <sub>2</sub> O reduction)		State, Local Ag. Ext.	Low to Medium	Low	• Most of the benefit achieved at feedlots.
2.4	Reduce Non-Farm (Residential and Commercial) Fertilizer Use					•
2.5	(Additional option, if/as suggested)					•

		Priority: High, Med, Low	Implement. Level & Lead Agency	Potential Emission Reductions	Indicative Cost (\$/tCO <sub>2</sub> removed)	Other Information, Co-benefits, Feasibility Consideration, Examples of Current Activities
2.6	(Additional option, if/as suggested)					•
	<b>Agriculture – Soil Carbon Management</b>					
3.1	Conservation Tillage/No-Till (carbon sequestration and reduced energy use)					• Boll Weevil eradication program requires cotton residue to be plowed under (conservation tillage not applicable to cotton)
3.2	Reduce Summer Fallow					• Applicability to AZ?
3.3	Increase Winter Cover Crops					• Applicability to AZ?
3.4	Improve Water and Nutrient Use					• Linked to Option 2.1 above.
3.5	Rotational Grazing/Improve Grazing Crops and or Management					•
3.6	(Additional option, if/as suggested)					•
	<b>Agriculture – Land Use Change</b>					
4.1	Convert Land to Grassland or Forest					•
4.2	Reduce Permanent Conversion of Farm and Rangelands to Developed Uses					• Reductions occur both from higher retention of carbon in soil and lower transportation activity. • Linked to Option 4.3. • Linked to Smart Growth Options in the TLU TWG.
4.3	(Additional option, if/as suggested)					•
4.4	(Additional option, if/as suggested)					•
	<b>Agriculture – Farming Practices</b>					
5.1	Organic Farming					•
5.2	Programs to Support Local Farming/Buy Local					•
5.3	(Additional option, if/as suggested)					•
5.4	(Additional option, if/as suggested)					•
	<b>Forestry – Biomass Protection and Management</b>					

		Priority: High, Med, Low	Implement. Level & Lead Agency	Potential Emission Reductions	Indicative Cost (\$/tCO2 removed)	Other Information, Co-benefits, Feasibility Consideration, Examples of Current Activities
6.1	Forest Protection – Reduced Clearing And Conversion to Nonforest Cover					•
6.2	Increase Maintenance of Urban and Residential Trees		State, City/ local			•
6.3	Afforestation of Nonforested Rural Lands		State, USFS			•
6.4	Afforestation of Nonforested Urban Lands		State, USFS			•
6.5	Reforestation/Restoration of Forested Lands		State, USFS			•
6.6	Reforestation or Increased Stocking of Stands		State, USFS			•
6.7	Age Extension of Managed Stands		State, USFS			•
6.8	Thinning and Density Management of Managed Stands		State, USFS			•
6.9	Fertilization and Waste Recycling					•
6.10	Expand Short Rotation Woody Crops (for fiber and energy)					•
6.11	Expanded Use of Genetically Preferred Species					•
6.12	Modified Biomass Removal Practices (reduced decay and energy use)					•
6.13	Fire Management and Risk Reduction Programs					•
6.14	Forest Health Risk Reduction Programs (pest/disease, invasive species)					•
6.15	Drought Management Programs (tree selection, placement, protection)					•
6.16	Flood and Riparian Management Programs (tree selection, placement, protection)					•

		Priority: High, Med, Low	Implement. Level & Lead Agency	Potential Emission Reductions	Indicative Cost (\$/tCO <sub>2</sub> removed)	Other Information, Co-benefits, Feasibility Consideration, Examples of Current Activities
6.17	Watershed Management Programs (stand retention, enhancement and management)					•
6.18	Habitat Management Programs (stand retention, enhancement and management)					•
6.19	(Additional option, if/as suggested)					•
6.20	(Additional option, if/as suggested)					•
	<b>Forestry - Wood Products and Waste</b>					
7.1	Improved Mill Waste Recovery					•
7.2	Improved Logging Residue Recovery					•
7.3	Expanded Use of Small Diameter Trees for Wood Products and Energy					•
7.4	Expanded Use of Wood Products for Building Materials					•
7.5	Expanded Use of State and Locally-Grown Wood Products					•
7.6	(Additional option, if/as suggested)					•
7.7	(Additional option, if/as suggested)					•
	<b>Forestry – Energy Production</b>					
8.1	Expanded Use of Forest Biomass Feedstocks for Electricity (fuel switching)					•
8.2	Improve Use and Efficiency of Wood for Direct Commercial Heat and Energy					•
8.3	Improved Energy Capture from Wood Waste Combustion					•
8.4	Expanded Landfill Methane Recapture (wood products waste)		State	Low	Neg to Low	• Federal New Source Performance Standards and Emissions Guidelines require methane capture at larger landfills.

		Priority: High, Med, Low	Implement. Level & Lead Agency	Potential Emission Reductions	Indicative Cost (\$/tCO2 removed)	Other Information, Co-benefits, Feasibility Consideration, Examples of Current Activities
8.5	Improved Commercialization of Biomass Gasification and Combined Cycle					•
8.6	Expand Usage and or Efficiency of Wood Waste as Residential Fuel Source			Low - Medium		• Overlap with RCI sector.
8.7	(Additional option, if/as suggested)					•